Social Context-awareness

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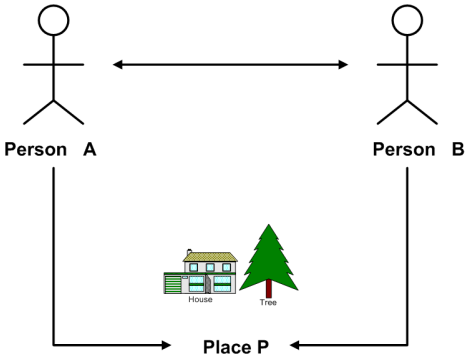
Outline

- P3 Systems
- Some examples
- Place Discovery, Labeling, and Representation
- Location based services:
  - Recommender Systems
  - Geotemporal social matching
- Privacy
- Browsing the World

Part 1

P3 Systems



The Interaction Society

1960 **Calculation**: the computer of yesterday was occupied with crunching numbers

1990 **Communication**: improvements in communication people-to-people to irrespective of local geography (Email, ICQ, Skype, etc.)

2000 **Interaction**: location aware computing systems can locate individuals as they go about their daily activities and help their social life.

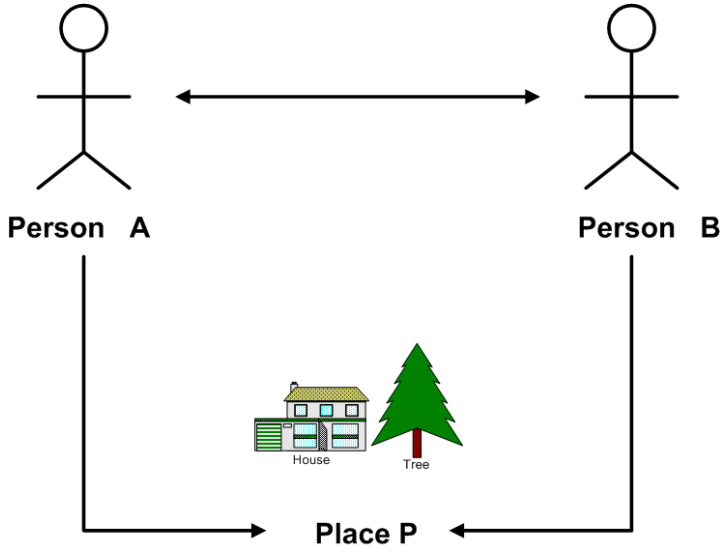
time

Enabling Technologies

- **Portable devices**: mobile phones, palms, notebook
- **Communication Infrastructure**: wi-fi, umts, bluetooth, rfid, sensor nets
- **Localization technologies**: GPS, e-odt, a-gps

People-to-people-to-geographical-places Systems

The availability of such technologies enables a new class of location-aware systems that link **people-to-people-to-geographical-places (P3 systems).** P3 systems combine computer-mediated communication and location data to provide appropriate geographic context to person-to-person interaction.



- P3 systems can strenghen the relationship between social networks and physical places.
- They can also help individuals leverage location information to make new social ties and coordinate interaction that reinforces existing ones.

Contextual Factors of a P3 Systems

P3 Systems take into account:

- **People properties**: individual user's attributes and properties, including general attitudes as well as interests and current disposition
- **Place properties**: include place-type (such as restaurant or classroom), who frequents the location in question, social norm concerning people's expected behaviours in that place, etc.
- **People-place relationship**: include user's familiarity with a given place and details such as whether they have distinct roles in this location
- **People-people relationship**:include whether users already know each other, have mutual acquaitance, belong to the same organization, etc.

P3 Systems design approaches

User interface		**Synchronous communication**	**Asynchronous communication**
People-centered	(1)Absolute user location	Uses remote awareness of current user location	Uses people location histories
	(2) Co-proximity	Uses real-time inter-users co-location for the exchage of social information	Uses co-location history to enable future interaction
Place-centerd	(3) Use of physical places by people	Uses online representation of user's current use of physical spaces	Uses history of people's use of a particular space
	(4) Interaction in Matching Virtual Places	Uses synchronous online interaction spaces related to physical location	Use asynchronous online places interaction related to physical location

People-centered Vs Place-centered

- **People-centered** tecniques use location information to support interpersonal awareness, enable communication, etc.
  - Eg., The Weasley clock in Harry Potter

- **Place-centered** tecniques link virtual places to physical locations, using social information to aid place-based navigation and decision making
  - E.g., The Marauder's Map in Harry Potter

Absolute location Vs Co-proximity

- **Absolute user locations** techniques tell you where your buddies are (latitude, longitude, altitude).
  E.g., (44.00, 10.33, 100), at home, room 35

- **Proximity** between users –or relative locations- techniques only tell which buddies are close to you or to a friend.

Synchronous Vs Asynchronous Communication

- **Synchronous location awareness** refers to the provision of current information about user location. Note: this location awareness need not necessarily be reciprocal, in the sense that the system may provide a user with a buddy's location without necessarily providing the buddy with the user's location.

- **Asynchronous location awareness** refers to the provision of historical information about user location.

Part 2

P3 Systems Examples

Representative P3 Systems

User interface		**Synchronous communication**	**Asynchronous communication**
People-centered	(1)Absolute user location	ActiveBadge, Ulocate	Ulocate's history function
	(2) Co-proximity	LoveGety	SocialNet
Place-centerd	(3) Use of physical places by people	ActiveCampus	Folkmusic
	(4) Interaction in Matching Virtual Places	Geonotes	ActiveCampus

Active Badge

The Active Badge system provides a means of locating individuals within a building by determining the location of their Active Badge. This small device worn by personnel transmits a unique **infra-red signal** every 10 seconds. Each office within a building is equipped with one or more **networked sensors** which detect these transmissions.

The location of the badge (and hence its wearer) can thus be determined on the basis of information provided by these sensors.

Ulocate

uLocate is North America's leading publisher of mobile location services. As a pioneer in the mobile LBS market, uLocate have launched applications including friend finders, point of interest locators, and photo tagging applications.

LoveGety

The Japanese LoveGety supports human interaction across really short distances. The LoveGety is a **matchmaking device** that communicates with **co-located devices** in the near proximity of its user, i.e., around 10 meters.

- There's a LoveGety for man (blue underside), and a LoveGety for woman (pink underside)

- Owners can set the device to show display lights according to whatever mood they are in (there are only three): "let's just chat," "let's go sing some karaoke," or the "Get together" mode.
- When one LoveGety detects another of the opposite sex within range, it beeps and flashes green if both are in the same harmonious mode, and red if the opposite user is sending out a different mode.

ActiveCampus

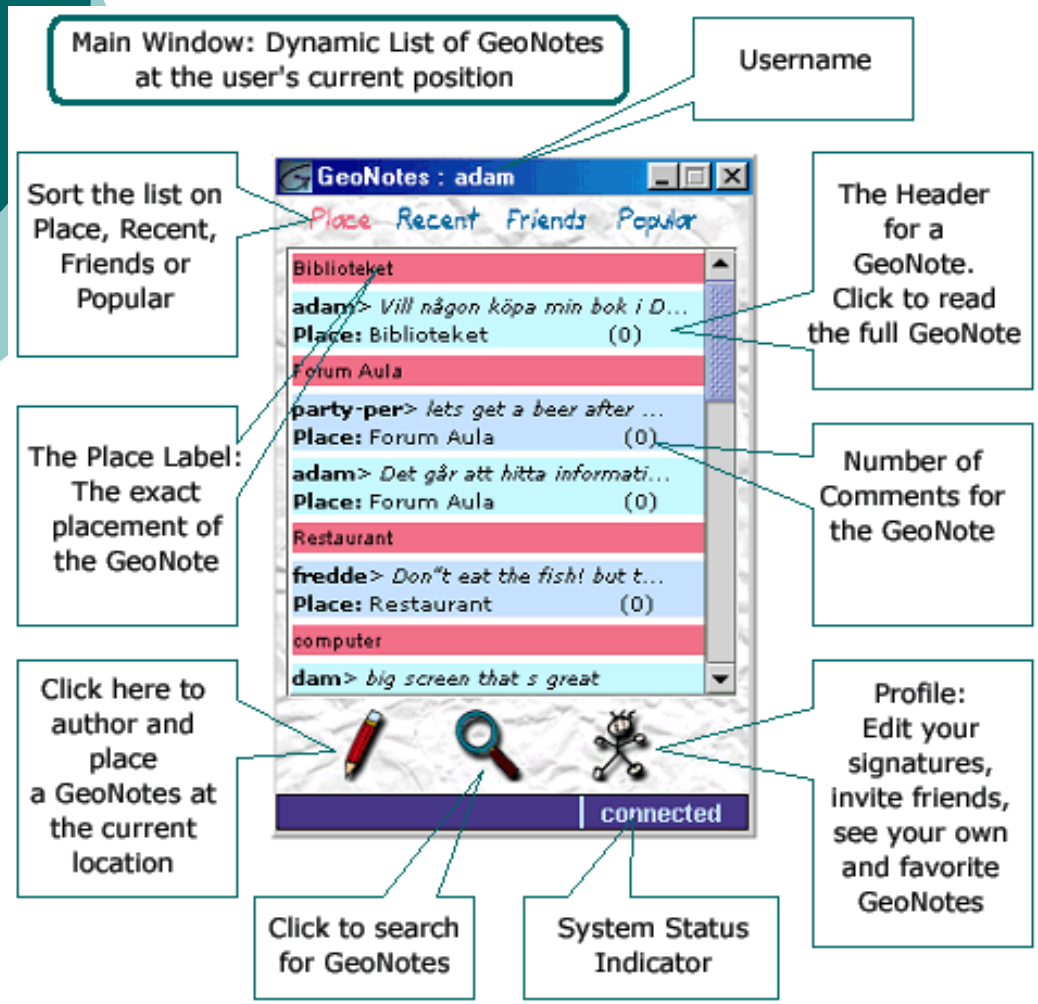
The ActiveCampus project aims to provide location-based services for educational networks.

Two services:

- **ActiveClass** enables collaboration between students and professors by serving as a visual moderator for classroom interaction. E.g., Ask anonymous questions. (Class as Virtual Place)

- **ActiveCampus Explorer** uses a person's context, like location, to help engage them in campus life. It consists in a suite of complementary services:
  - What's around
  - Who's around
  - Graffiti (Msn, ICQ, etc…)

Geonotes



When you want to create a **GeoNote** at your present location, you do not have to specify your position to the system. Via your connection to the Wireless LAN base-station (see Before you start the application) , GeoNotes automatically detects where you are. You are always 'here'.

However, W-LAN positioning can be rather rough and crude. In order to give GeoNotes authors and readers guidance to its exact position, each GeoNote is filed under a place label. **Place labels** are created by authors each time they create a GeoNote.

Part 3

Place Discovery, Labeling, and Representation

Place Discovery, Labeling, and Representation

P3 Systems need to represent places, obtain description for them and identify when a user is "at" a place. Algorithms for defining places and obtain labels are not stated.

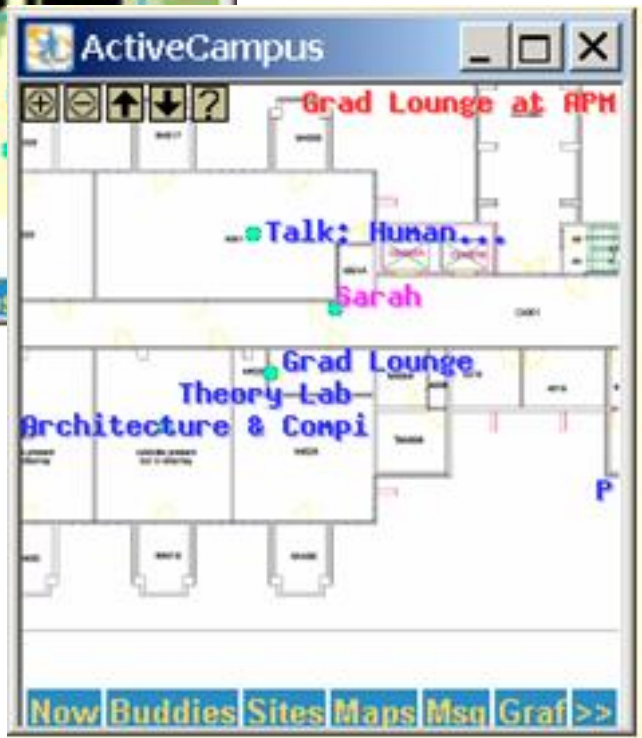
Some guide lines:

- **Expressive representations of places**, combine geometric representation (e.g., latitude,longitude) and logical representations based on places, their interrelationships, and perhaps even their temporal properties (e.g., a room might be used as a class room during the day and dance floor in the evening.)
- Algorithms for aiding users in social navigation tasks must also be able to utilize **relational and dynamic properties of places**.

  For example: What does it mean for a place to be crowded?
  When is discourse typically active?

- Scalability requires algorithms to be interactive and place **descriptions to be shared among users**

Different Places Representation



Part 4

Location Based Services

- P3 Recommender Systems
- Geotemporal Social Matching

Location Based Services

- LBS provide mobile-device with personalized services tailored to their locations.
  - Reactive LBS
  - Proactive LBS

- Classification of time and space resolution for information:

	Geographically located	**Geographically indipendent**
Localized in time	Traffic reports	Share price
Time indipendent	Restaurant location	Music recordings

Location Based Services (2)

Desire for geographically located information:

	Stable information	**Dynamic Information**
Activity done in a place frequently	**Need: Low** Eg., What is the train schedule?	**Need:Moderate/High** Is the 10:17 a.m.train on time today?
Activity done in a place infrequently	**Need: Moderate/High** How do I get to a restaurant I rarely visit?	**Need: High** What movies are playing this afternoon at a cinema I don't go often?

P3 LBS:

- P3 Recommender Systems
- Geotemporal Social Matching

P3 Recommender Systems

- **Recommender systems** use knowledge of user preferences and item properties to identify what users are likely to enjoy.

  E.g. news services on cell phones

- **A P3 recommender system** represents and resons with user preferences – either inferred from use or stated explicitly – about both places and people activities.

  E.g. A system might recommend natural foods restaurant to users that regularly visit organic markets.

P3 Recommender Systems (2)

- We can use **collaborative techniques** to derive more effective reccomendation.

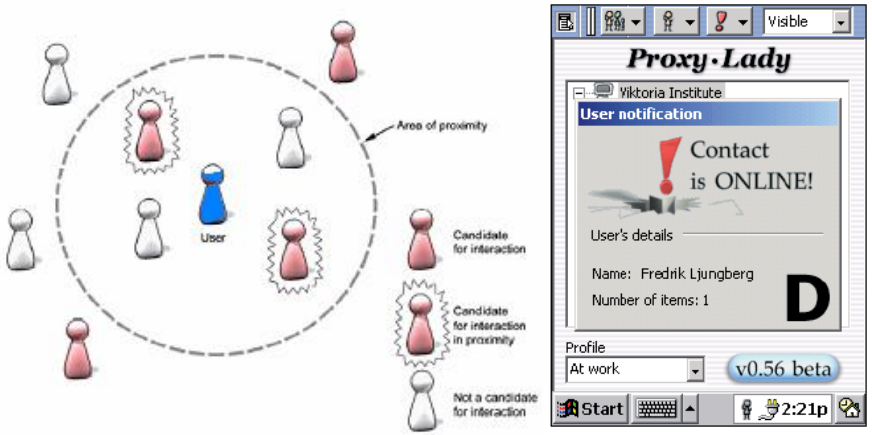
  E.g., A system could infer users' preferences for particular types of cousine from the restaurants they frequent.

  The system might base restaurant recommendation combining users' preferences and restaurant's current status (wait time for a table, ambient noise levele, etc.)

- When virtual spaces are associated with physical places, a common use is to let users enter **ratings and** express **opinions**, which place-based recommender systems could use in turn.

Geotemporal Social Matching

Social matching systems are recommender systems that bring people together in both physical and online spaces.

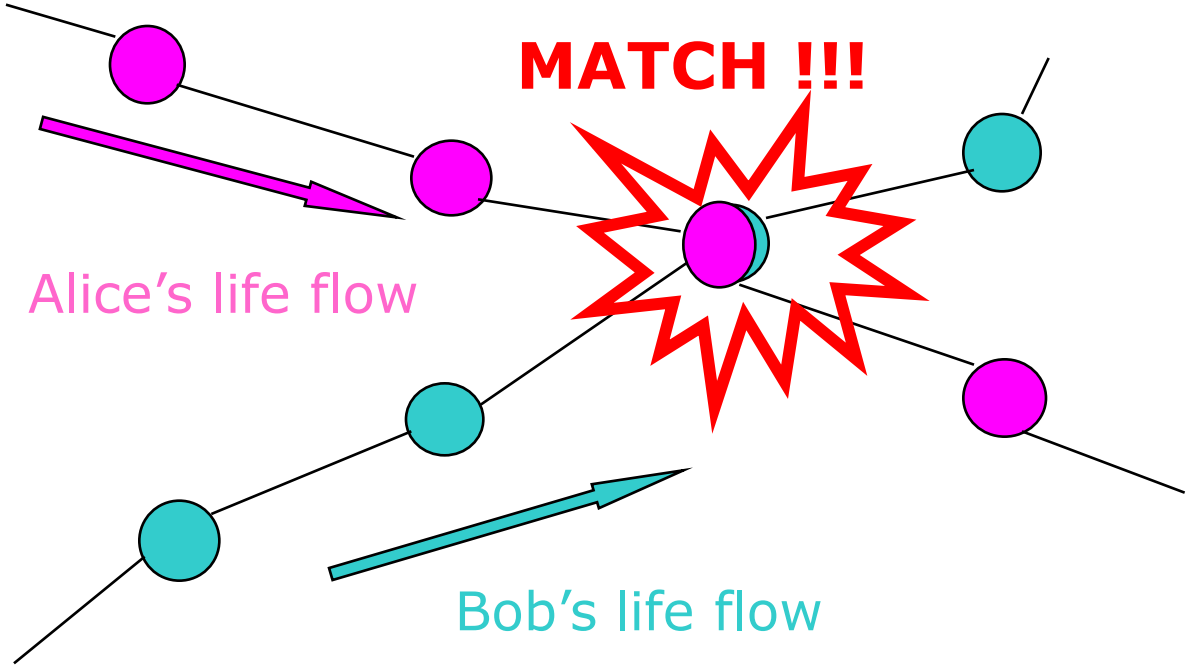


- Social matching systems typically include **match-alert mechanisms** and introduction-management tools.
- They often do so by providing users with access to various aspects of other **users' profiles** through listings or social network visualizations. Profiles can change over time and be linked to **reputation measures**.

Geotemporal Social Matching (2)

Geotemporal social matching systems are a class of P3 recommender systems that leverage users' geotemporal histories to match individuals.

- In everyday life, we often use location to find social matches without the aid of computers — for example, we find our colleagues at work, and we often meet friends at pubs…



Same time

&

Same place

Geotemporal Social Matching (3)

Social-matching algorithms exploit, and combine, each of these P3 system techniques:

- We can use stored **absolute-user-location** data to derive affinities based on similarities among users' geotemporal routines. Algorithms for matching location histories search for common or nearby locations and similar paths. Such algorithms would be even more effective if they learned to use information about place-types;
- **Collocation data** is the most common trigger for geotemporal match alerts: when individuals with matching profiles come into proximity, they receive alerts suggesting that they meet. We need to combine such introduction alerts with identity-revelation tools that let users meet while maintaining control of their personal data.
- Use of **physical places data** can be used to determine the appropriateness in terms of timing and content of individual match alerts.
- Users' use of **matching virtual places** provide a safe place for virtual, and perhaps asynchronous, introductions.

Part 5

Privacy Concerns

Privacy Concerns

Many researchers have explored **privacy and security issues** in collaborative and ubiquitous computing systems.

The P3 systems framework can help us identify the privacy concerns associated with the various techniques:

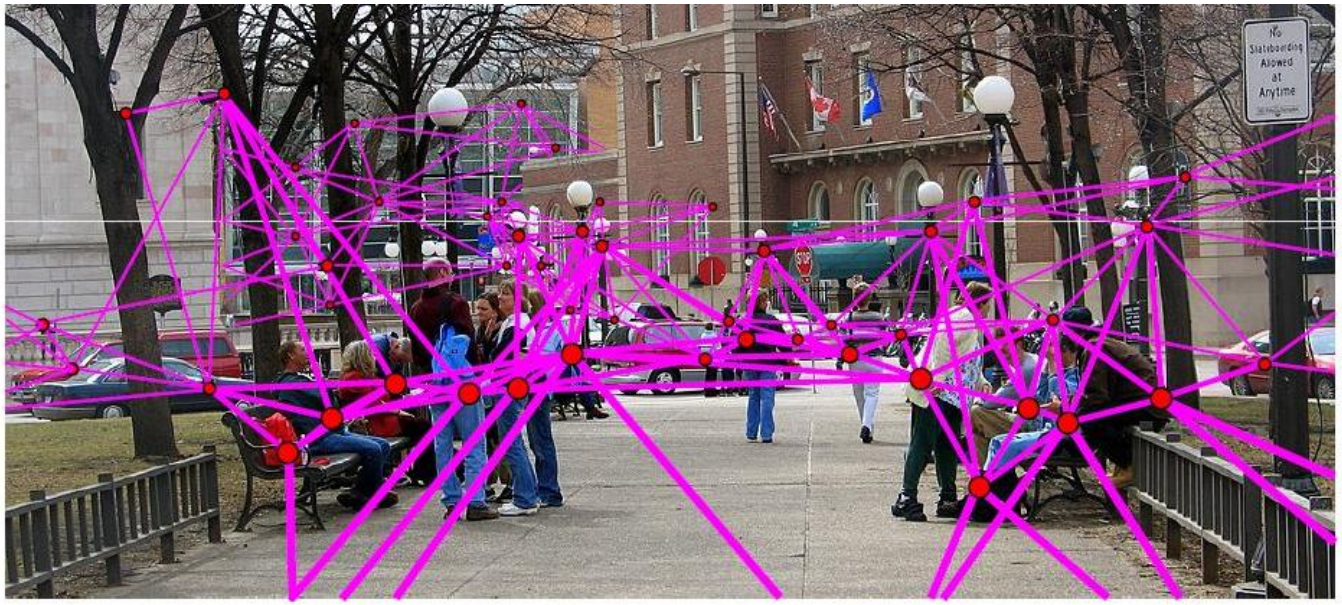
- For **absolute user location techniques**, the key issue of concern is the possibility of "stalking" or simple violations of users' desire for privacy. Using this technique makes sense only in the context of strong social ties between users e.g., family members.
- For **collocation proximity** techniques, the key concerns are associated with geotemporal social matching and identity management. E.g., an individual waiting @ a train platform
- Uses of **physical places** techniques don't necessarily raise as many privacy concerns as people-centered techniques because they often require only anonymous data about physical activities in a given place.
- The interactions in **matching virtual places** techniques raise privacy issues similar to more traditional forms of computer mediated communication systems.

Part 6

Browsing the world

by Agent and Pervasive Computing Group

Pervasive Scenario

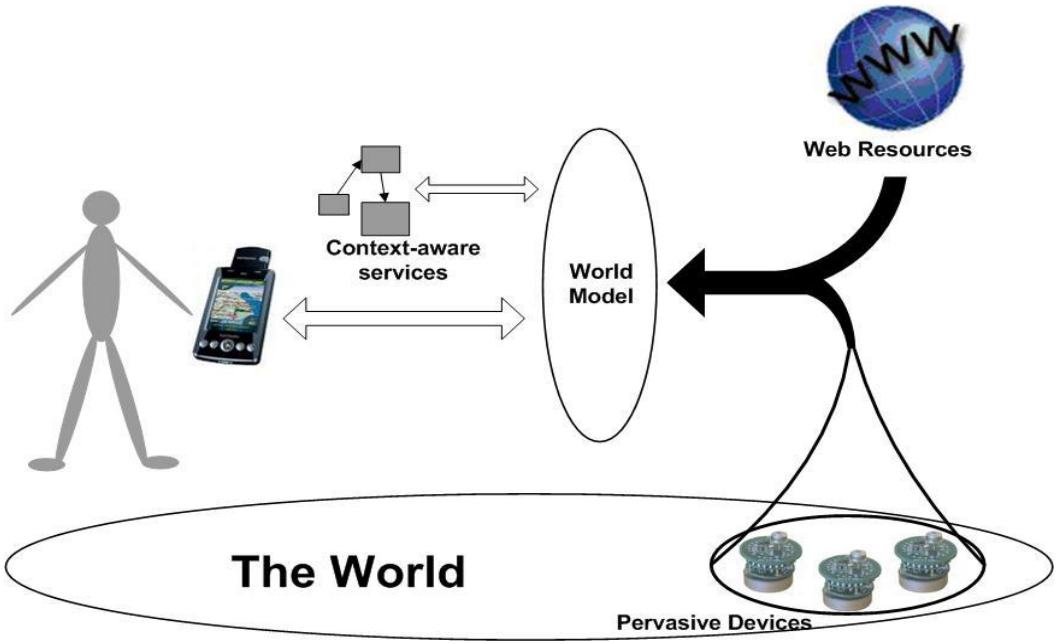


- Computer-based systems and sensors will be soon embedded in everywhere:
  - all our everyday objects
  - all our everyday environments (house, offices, cities)
- A truly pervasive network generating increasing amount of information: wsn, RFID, PDA & GPS, Web 2.0

Browsing the world
Agent and Pervasive Computing Group

A general-purpose solution must provide:

- A **general model** to represent context information and to build a world model.
- a **general infrastructure** supporting the model



Challenges

- **Data Model:**

a simple, general-purpose and uniform model to represent contextual information as individual data atoms as well as their aggregates.

- **Access to data:**

the very goal of knowledge networks is to digest data from any possible contextual data source and to provide knowledge to agents.

- **General Approaches for data aggregation and networking:**

It should be a "live layer" continuously and autonomously analyzing information to aggregate data atoms, relate existing knowledge atoms with each other, and extract meaningful knowledge from the available data.

- **Application-specific views:**

specific agents may require the dynamic instantiation within the knowledge networks of application-specific algorithms for knowledge analysis.

The W4 Context Model

- A simple model in which context data is expressed by a four field structure: Who, What, Where and When.
- Someone or something (***Who***) does some activity (***What***) in a certain place (***Where***) at a specific time (***When***)
- Who is acting? What is he/she/it doing? Where and when the action takes place?

W4 examples

Gabriella is walking in the campus' park. An agent running on her PDA can periodically create a **knowledge atom** describing her situation.

Who: user:Gabriella
What: works:pervasive group
Where: lonY, latX
When: now

- Gabriella is walking in the campus, and wants to know if some colleague is near. She will ask:

Who: user:*
What: works:pervasive group
Where:
circle,center(lonY,latX),radius:500m
When: now

W4 Knowledge Networks

- Producing new information by navigating the knowledge network and combing and aggregating **existing information** into new data atoms is a 2 step process:
  - **Step 1:** indentification of all possible correlations between knowledge atoms
  - **Step 2:** generation of new knowledge atoms

- It is general enough to let the knowledge networks perform first a preliminary organization and correlation of atoms useful for all possible services that could access it
- then carry out only the new knowledge that will be reasonably used by services.

W4 Knowledge Networks

Those correlations may be used as a base for more elaborated inference and reasoning upon knowledge networks and eventually creating new W4 knowledge atoms

Who: Gabriella Mother's house
What: -
Where: lngY, lat X
When: -

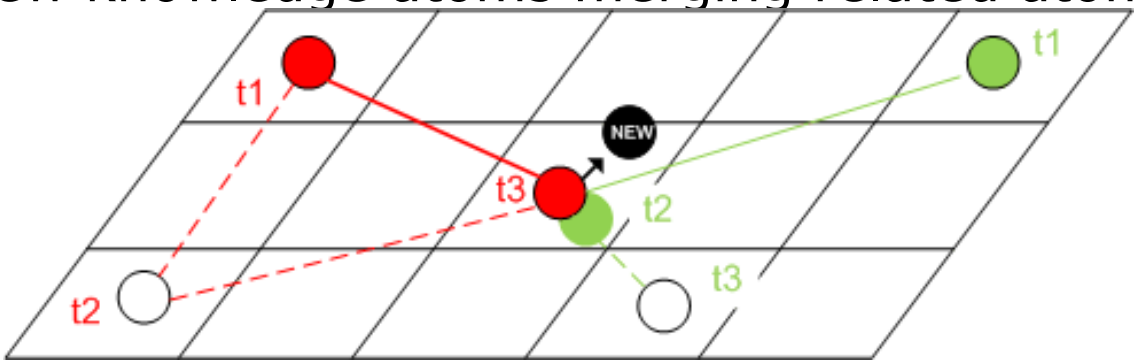
Who: user:Gabriella
What: -
Where: lngY, lat X
When: 2006/12/25 10:00a.m.

Who: day: Christmas day
What: -
Where: -
When: */12/25

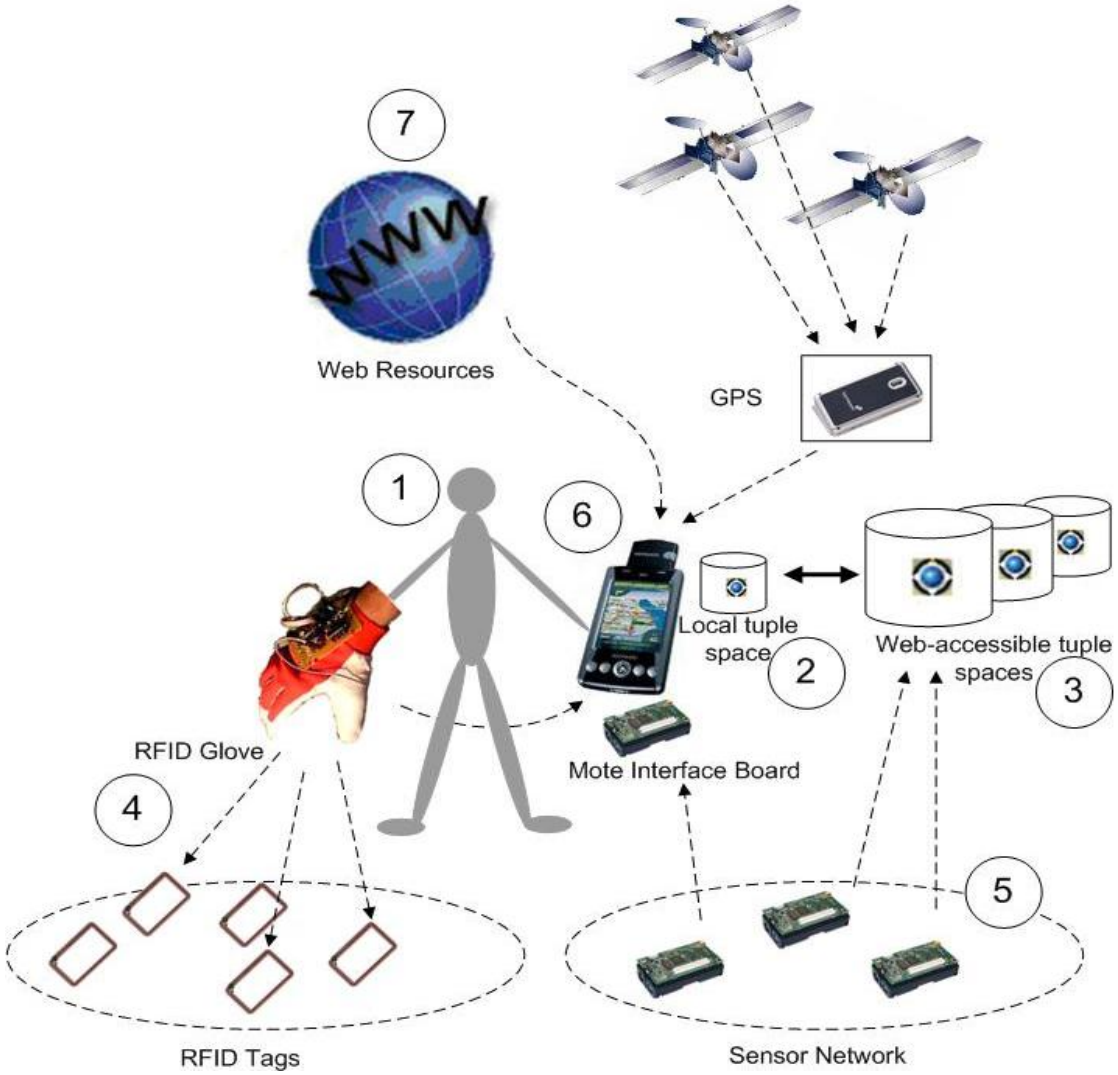
Who: user:Gabriella
What: -
Where:Gabriella Mother's house
When: day: Christmas day

Self-Organizing Approach

- A self-organizing approach is clearly required by:
  - the decentralized nature of pervasive computing systems
  - the overwhelming amount of generated data
- **Knowledge Linking**: **Spider agents** continuously surf W4 Tuple Spaces in order to retrieve tuples that fulfill the specific relationship, those tuples are virtually linked together thus creating a W4 knowledge network.
- **Knowledge Generation**: **Browser agents** generate new knowledge atoms merging related atoms.



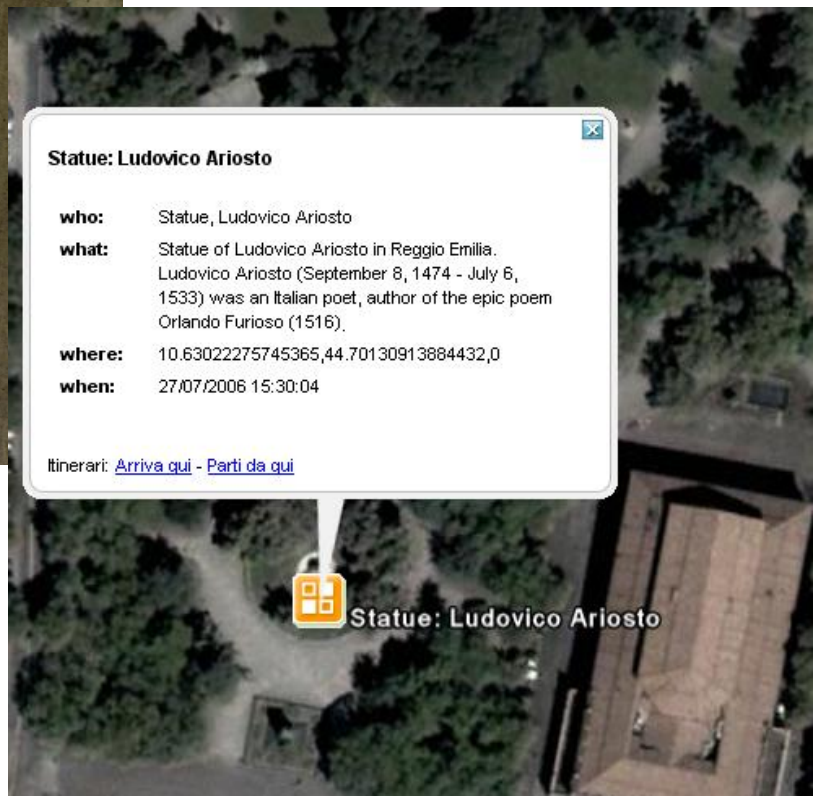
Browsing the World Architecture



Journey Map

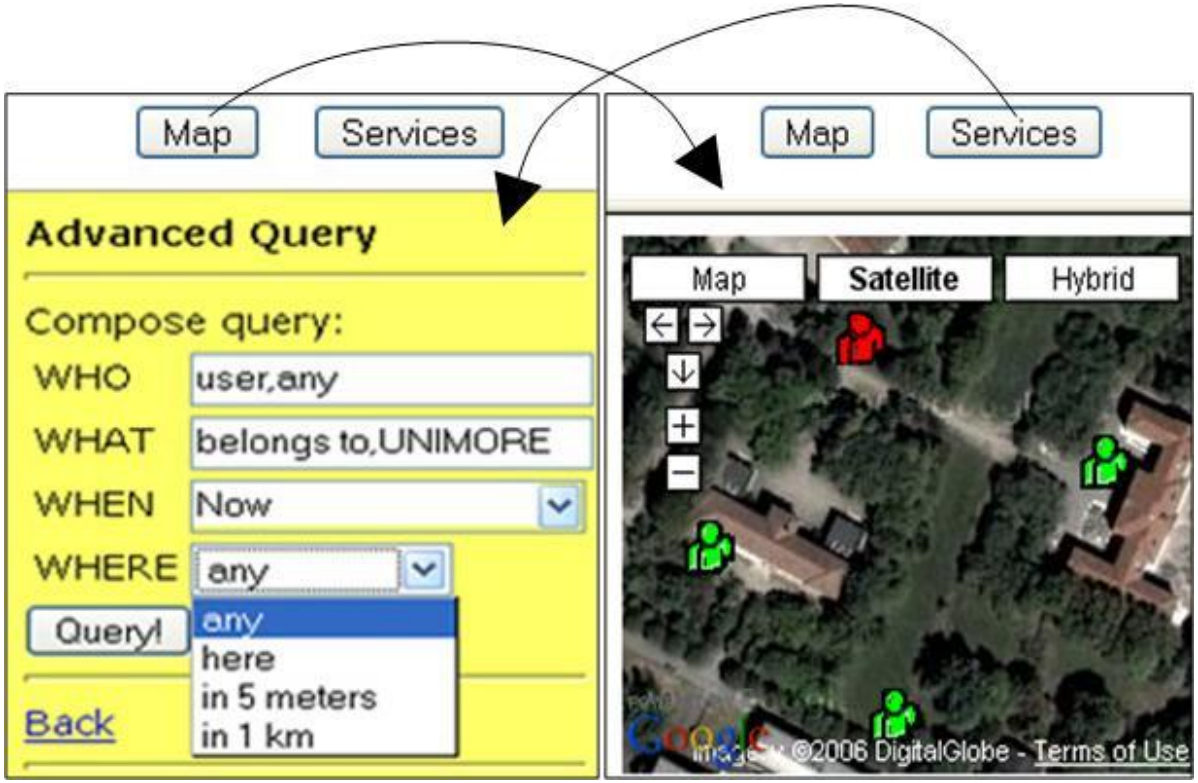
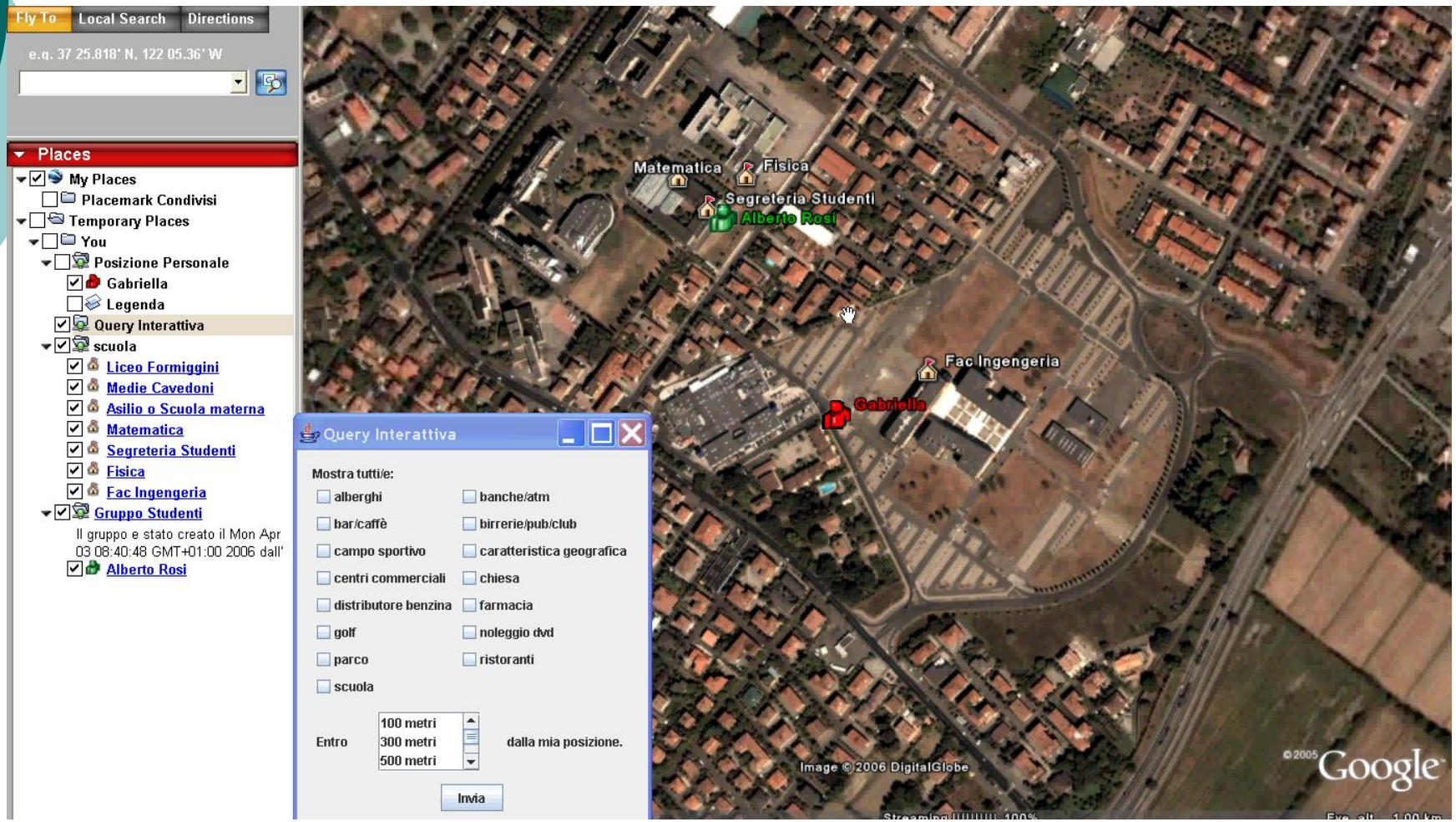
A tourist wants to automatically build and maintain a diary of his journey.

Journey Map (2)



The People Map

Group of friends can share their actual GPS locations (represented as knowledge atoms) with each other.



Real Time Map